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The Adoption of Interrelated Innovations: A Critical Test of Technological Regime Theory

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Abstract

Banking technologies had two distinct generations: mass automation (MA) and electronic banking (EB). The established Technological Regime (TR) theory predicts that a bank's accumulation in MA technologies may not impact its adoption of EB. On the hand, banks' IT literacy acquired in the former generation is the primary antecedent of the adoption of EB. This study tests this theory and proposes a rival perspective of technological interrelatedness to refine it. In the transition between these two generations, many inter-related innovations were introduced, and may evolve into new systemic technologies, achieving synergy. Firms adopt innovations, hence acquire IT literacy, mostly in a piece-meal way, resulting in previous adoptions either supplementing (an accumulation case), or constraining (a burden case) the adoption and integration of current innovation in achieving synergy. The results of a case study, using secondary and interview data from four banks and two industrial experts in Taiwan, reveals that the RB technologies become banks' burden in adopting EB innovations, and the concept of IT literacy should be re-examined in the context of inter-related technologies.

Keywords: innovation outcome, electronic banking, technological change, innovation burden, technological regime, inter-related innovations

1. Motivation and Research Question

Financial service is characterized by high information density. Compared to other industries, banking is more likely to utilize information technology (IT) to process the huge amount of information produced. In the early 1960s, the origin of the mass automation generation, banks adopted mainframe computers to automate their back offices' processes. With the advent of telematics technology, some transactions were later on converted to on-line real-time operations. This technological trajectory helped banks satisfying the mass consumption of banking services, increasing return to scale, and enhancing their ability to expand in size (Buzzacchi et al., 1995).

In the 1970s, the advent of network technologies, client-server and distributed data processing applications created a disruption of banking technology that laid the foundation for *electronic banking* (EB) innovations (Buzzacchi et al., 1995). Electronic banking refers to "the non-clerical, customer self-served banking channel or electronic branch enabled by computer and communication technologies (Chen, 1999)." Advocates claim EB created greater opportunities for product and service innovation, with reduced costs, improved product and service quality, and increased customer value (Lee, 1998a; Lee, 1998b). Some predict EB innovations will become a strategic weapon that no bank can ignore (Daniel and Stroey, 1997; Lerew, 1997; Toone, 1997).

However, in spite of the striking potential benefits, many banks still hesitate to adopt, or fail to implement EB successfully. Evidence shows that the EB adoption in banking organizations is not always deemed a success (Jiang, 1995; Lee, 1998b; Lou, 1995). *Why did some banks adopt EB earlier than the others? Why and how did banks varied in their extent of implementation?*

Organizational innovation (OI) theory is an appropriate discipline for investigating EB adoption (Frambach et al., 1998; Sciuli., 1998). Most previous OI research has assumed that: (1) firms can choose to adopt or reject an innovation without regard to the effects or influences from previous adoptions; and (2) innovation arrives as a perfect invention (Damanpour, 1991; Silverberg, 1991). Some researchers criticized that previous studies for their inability to capture the rapidly evolving and emerging nature of IT (Clark and Staunton, 1989; Lee, 1994; Silverberg, 1991). This study uses the concept of technological interrelatedness, derived from the conception of technology as an evolutionary system (Silverberg, 1991), to characterize the nature of emerging information technologies (Chen and Lee, 2000; Chen, 1999) and develop one possible line of inquiry for the above question.

This study is based on the belief that, in the context of interrelated technologies, the way a firm has adopted and accumulated technologies in the past may have significant impact on its current adoption of innovations (Chen and Lee, 2000). During the period of rapid technological progress, many inter-related innovations were introduced in industry. Overtime, these technologies may evolve into a new systemic technology, achieving synergy (Silverberg, 1991). Meanwhile, firms may adopt innovations in a piece-meal way to respond to their changing business needs.

A firm's results from previous implementations may either supplement (an accumulation case), or constrain (a burden case) the current innovation adoption in achieving synergy. For example, it may be difficult for Internet banking to utilize existing data in MA systems capitalized on a mainframe computer. To lessen such difficulty, a structural redesign of banks' information systems and processes might be necessary (Buzzacchi et al., 1995).

Since the disruption in banking technologies may cause problems in banks' integration of new technologies, previous investments in MA technology may become a burden when deploying EB. The established Technological Regime (TR) theory, however, predicts that a bank's accumulation in MA technologies may have no impact on its adoption of EB (Buzzacchi et al., 1995). This study tests and reappraises this theory and compares it with the above rival perspective, and explains why and how banks' variation in innovation history affects EB innovation

2. The Rival Explanations

2.1 Predictions from TR theory

The technological trajectory of MA generation was strongly focused in the direction of increased efficiency in producing the portfolio of banks' services and products. At first, the locus of the innovation process was largely external to the banking sector. Nevertheless, banks were quickly exploring in depth the potential of MA technologies. Through the cumulative effects and learning by using, service quality was first greatly improved, authentic and complementary innovations, especially application software, were embraced. The organizational and managerial innovations necessary for effective utilization of MA technologies were subsequently developed. During this process, banks accumulated abundant firm-specific and appropriable tacit knowledge about technology and banking activity (Buzzacchi et al., 1995).

Buzzacchi et al. (1995) argue that the scientific and technological knowledge of the two generations have very little in common. When transitioning between these two generations, this shift in technological trajectory led to a substantial devaluation of the prior stock of knowledge skills. Based on the concept of absorptive capacity (Cohen and Levinthal, 1990), they asserted that a bank's stock of knowledge and capabilities accumulated in the former generation, therefore, do not help it absorb EB innovation effectively. Hence, they expected that

H1: *a bank's technological accumulation in MA technology should have no influence on this bank's innovative performance in EB (see fig. 1).*

Yet, during the Mass Automation generation, banking personnel at all levels might discover the key role of data processing and gained experience in IT usage, resulting in growing IT literacy. Again, based on the concept of absorptive capacity (Cohen and Levinthal, 1990), they asserted that abundant IT literacy might form a knowledge base endowing a bank with the ability to absorb EB technologies (Buzzacchi et al., 1995). Hence, TR theory expected that:

H2: *Those innovative banks, with a high level of IT literacy, are likely to be more responsive to demand stimuli for EB from customers. Banks lagged behind in MA technologies struggle to cultivate IT literacy, resulting in a disadvantage regarding the adoption of EB technologies.*

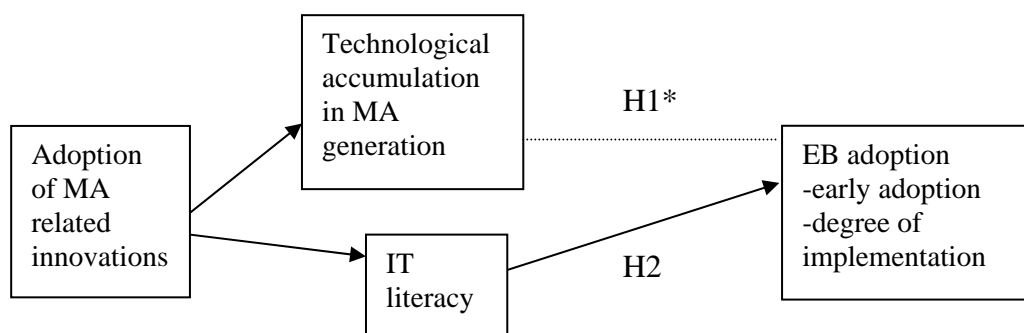


Fig. 1 Technological Regime theory

*: Have no effects on the outcome of EB adoption

2.2 Innovation Burden: A Rival Explanation

Though TR theory provides an interesting perspective on the role of technological accumulation, it is not an explicit construct and has been largely ignored by traditional research (Lee, 1994). This study thus suggests one more, perhaps better, explanation based on the new concept of technological inter-relatedness. One of the most distinctive characteristics of emerging IT, it refers to the possibility that a firm can achieve synergy by integrating an innovation with the technologies it has acquired previously (Chen and Lee, 2000).

The interrelatedness between different technologies is bred during and shaped by the evolutionary path for those technologies to form a systemic technology, where the systemic technology refers to a product made up of many elemental technological modules (Silverberg, 1991). When technological leaps become obvious, numerous technology producers with uniquely designed products compete for the new market. As firms increased, the range of experimentation and product innovation broadened accordingly. Eventually, knowledge of components' integration will develop to achieve synergy between different technologies. Systemic technologies emerged through the incremental accretion and accumulation of these interrelated innovations (Lee, 1994; Tushman and Anderson, 1986).

Innovation may be viewed as a higher degree of technological inter-relatedness if it is compatible to, and can be successfully integrated with, a firm's technological accumulation. A firm's results from previous adoptions may help the current innovation in achieving synergy. Hence, echnology accumulation is very likely facilitating innovation adoption. The formation of a systemic technology may involve a long evolutionary process. Furthermore, before the emergence of a dominant design, many systemic technologies may evolve concurrently (Tushman and Anderson, 1986). Therefore, firms do not know when a systemic technology will emerge. It is also impossible for them to adopt a complete systemic technology at the beginning. During the evolution, however,

firms may adopt innovations in a piece-meal way and finally accumulate a large amount of technologies interrelated with the current innovation (Chen and Lee, 2000).

However, firms may also accumulate technologies in a way that is not conducive to the current adoption of innovation. A firm's results from previous adoptions of innovations may thus constrain the current innovation adoption in achieving synergy. As a result, technology accumulation may become a burden for innovation adoption. Implementing a complex technology induces both the individual learning to create and accumulate personal skills and experiences, and the organizational learning such that the personal know-how become embedded into organizational routines (Attewell, 1992; Dewar and Dutton, 1986). Know-how has to be discovered anew within organizations due to a lack of related technological knowledge and experiences. However, it takes time and effort for firms to learn and accumulate such know-how (Dhebar, 1996). Efforts for acquiring such know how may then become a burden or hurdle to adoption (Attewell, 1992; Dhebar, 1996)

Firms may probably hesitate to adopt an innovation perceived as having high burden. Eventually, an organization may find itself be locked in a particular development path of technology. This is because how skillful can a firm learn is close related to its innovative capability (Cohen and Levinthal, 1990). Since every firm has its own unique history, each firm accumulates technologies in its own way and builds an unique combination of technologies. This firm-specific technological accumulation may reciprocally reinforce the absorptive capacity for the adoption of related innovations, and will greatly enhance a firm's innovative capability (Avlonitis et al., 1994; Cohen and Levinthal, 1990). Because of its cumulative nature, it may be difficult for firms to acquire and exploit new technological knowledge immediately without an early investment in an emerging technology. It might be difficult for a firm to instantly switch from one generation to another new one (Chen, 1999; Lee, 1994). Furthermore, firms may have a higher stake in vested technology, whereby they may have an interest in postponing its usage. To reap more benefits, firms may insist in enlarging the utilities of the entrenched technologies.

To summarize, a firm's previous strategies for accumulating technologies may influence its current innovation outcome significantly. Given a set of emerging and possibly systemic technologies, the way a firm adopt and accumulate these technologies in the past may become a to-be-considered factor in choosing among innovations. In other words, the possibility that a firm can integrate an innovation with its existing technologies may be varied with its technology accumulation, an organizational characteristic reflecting its innovation history regarding a series of interrelated technologies (Chen and Lee, 2000).

The disruption of banking technologies may cause troubles for banks integrating these technologies to achieve a synergy. For example, firms with extensive experience and investment in Mass Automation technologies may face a paradigm, or infrastructure, shift problem when transitioning to EB (Buzzacchi et al., 1995). This paradigm shift may incur banks innovative in the former generation a prohibitive switching costs (Dhebar, 1996). Thus, previous investment in MA technology may become a burden when adopting EB. Hence, we proposes that:

H3: The innovative banks in the former era may be locked in MA generation, struggling to lift the burden, and left at a severe disadvantage when adopting EB technologies. (a burden case)

H4: Banks with higher degrees of technological accumulation in network technology, distributed data processing, and client-server applications, may achieve superior outcomes in adopting EB technologies. (an accumulation case)

3. Research Design

This study concerns firms' deployment of emerging IT. Two competing explanations are examined by taking a qualitative approach, using an analytical deduction case study method (Laudon., 1989;

Yin., 1994). Appropriate banks for such a test should be selected carefully (Markus, 1989). Generally, banks selected must be innovative in MA generation, such that the technological regime theory may have highest possibility to be true (Buzzacchi et al., 1995; Markus, 1989). Banks that adopted MA technology early on will have a higher level of IT literacy. Four banks were chosen as the empirical sites (See table 1 for the basic statistics of these banks).

Table 1 Basic Data of the Case Sites

	F bank	H bank	E bank	W bank
Employee number	6442	6440	1200	1100
No of IT department Member	198	125	80	56
Company History	100 year	94 year	7.5 year	8.5 year
IT department history	25 year	27 year	8~10 year*	9 year*
Capital	US \$ 1,263,000,000	US \$962,000,000	US \$ 334,000,000	US \$ 423,000,000
Tech department budget	US \$ 15,200,000 (Budget of IT Personnel not included)	unknown	Ranged from about US\$ 3,000,000 to 6,000,000	US \$ 6,000,000 (Budget of IT Personnel not included)
Electronic banking Service	Internet banking 、FEDI 、voice banking	Enterprise banking 、FEDI 、Internet banking, voice banking	Phone banking, enterprise banking, Internet banking	Non-clerk small branch or Kiosk 、Phone banking, Internet banking

*: set up before their bank's opening

F bank and H bank were chosen because they met the above criteria. They became one of the first banks to automate its data processing in the 1970s. They adopted MA applications 20 years earlier than E bank and W bank did. Among all the commercial banks in Taiwan, they were the first to process all their deposit transactions from all their branches with on-line and real-time technologies. At the time, only 30% of the commercial banks in Taiwan automated parts of their deposit transactions. Both banks now enjoy a larger number of automated branches, transactions, and funds involved. Over the past twenty years, MA applications grew rapidly, causing the number of IS personnel in these two banks to increase significantly. As the MA applications matured, they began to integrate these applications, and achieved a very high degree of integration among these applications.

E bank and W bank were chosen for the opposite reasons. Compared to F and H banks, banks E and W were very young and small. They lagged behind in MA generation, struggling to integrate different applications with a small IS department. According to the technological regime theory, these two banks should perform worse in EB adoption than both F and H banks. We can compare the empirical evidence from these two banks against that of H and F banks to verify the validity of predictions of TR theory in different contexts.

This study adopted the data collection procedure designed by Lee (1994). To increase the reliability of the case study, a case research protocol was designed and strictly followed in data collection (Yin, 1994). Twenty-five interviews totaling 3040 minutes were tape-recorded and transcribed. Appendix 1 shows the background of the informants and the records of the interviews. Each interview followed a semi-structured protocol, which allowed for open-ended responses. A copy of the case report was sent to informants for review and comments. For triangulation, multiple informants were selected for each case, and two industrial experts were interviewed four times. The first expert is the CEO of the largest company developing Mass Automation systems in Taiwan. He owns a Ph.D. degree in computer science, and participates this industry for more than 20 years. The second expert is a section chief of a non-profit foundation supported by Minister of Finance, Taiwan government. He owns a master degree in finance and is responsible for providing training and education services to participators of financial industry in Taiwan. He has a career in this job for more than 10 years. In addition, data from archives, articles, magazines, marketing research reports, government reports, etc., were also collected.

Pattern matching was used to analyze the empirical evidence. According to Yin (1994), researchers can compare an empirical pattern with a predicted one. The results can be used to disprove the validity of predictions made by theoretical arguments. If both of the empirical and predicted patterns coincide, the results tend to support the prediction. Before pattern matching was conducted, a case study database was encoded according to Miles and Huberman's (1994) general guides, and key words and sentences were identified. Three raters were asked to independently review, summarize and translate the empirical evidence into empirical patterns. The inter-rater reliability equals 0.881.

4. Research Findings

This study investigated how and why the deployment of emerging technology, in the context of interrelated technologies, is influenced by the level of technological accumulation. The most striking discovery is the strong effects of technological accumulation on the early adoption and implementation of EB technologies.

Empirical evidence shows H and F bank were highly innovative during the Mass Automation generation¹. According to the Technological Regime theory, the degree of IT literacy in these two banks is much higher than that of E bank and W bank. Since technological accumulation in MA technology plays no role in EB adoption, according to H1 and H2, we infer that these two banks' adoption of EB should be superior to E bank and W bank.

Evidence also shows that the accumulation of network, telecommunication, and client-server technologies was much greater in banks E and W than in banks F and H. For example, more than two thirds of the terminals in W bank are NT based. But F bank and H bank still use only proprietary terminals. In addition, more than one fourth of the IS personnel in E bank were acquainted with EB related technologies, this percentage was only about one thirtieth in F bank and H bank.

In addition, both F bank and H bank experienced a serious backlog of requirements in mass automation IS. The mass automation IS in these two banks, more than 20 years old, was originally based on a coherent architecture. Over the past 20 years, new requirements appeared rapidly and attempted to integrate with legacy systems to achieve synergy. After these numerous amendments, a

¹ Refer to the reasons why F and H bank are chosen as case sites mentioned in Section 3.

strange and complex architecture emerged, ridiculed by industrial experts as “squatter houses”. To keep enhancing the entrenched technology, they spent a majority of IS budgets and locked their IS personnel into this peculiar system. Unfortunately, building a new platform that integrates MA and EB applications will consume a much more huge budgets. Maintenance of this “squatter” system thus becomes a burden for the IS department. According to H3, H4, we infer that both E and W bank will perform much better in EB adoption.

Three raters reached the conclusion that both E and W bank were much more innovative in EB adoption. Table 2 summarizes the innovation outcome for the case banks in different kinds of EB technologies. The adoption of ATM was excluded in the rating of innovation performance. Since the advent and diffusion of ATM in Taiwan was earlier than the creation of E bank and W bank, these two banks couldn’t adopt it before F bank and H bank did. However, banks adopted ATM in part enforced by the Minister of Finance, Taiwan. This fact indicated that F bank and H bank, adopted ATM not too early, might more or less hesitate to adopt EB innovation since the early days.

Table 2 : Measures of Innovation Performance of the Case Banks

	H bank	F bank	E bank	W bank
ATM	1 : medium 2 : high	1 : medium 2 : high	1 : behind 2 : low	1 : behind 2 : high
Credit card	1 : behind 2 : low	1 : behind 2 : low	1 : medium 2 : low	1 : behind 2 : low
Voice banking	1 : ahead 2 : low	1 : medium 2 : low	1 : ahead 2 : medium	1 : ahead 2 : medium
Financial EDI	1 : medium 2 : low	1 : ahead 2 : medium	unknown	1 : medium 2 : low
Internet banking	1 : medium 2 : low	1 : medium 2 : low	1 : ahead 2 : medium	1 : medium 2 : low
Non-clerk small branch or Kiosk	1 : medium 2 : low	1 : medium 2 : low	1 : medium 2 : low	1 : medium 2 : low

1 : degree of early adoption 2 : implement degree

In general, the innovation performance for H bank and F bank were increasingly deteriorated. On the other hand, E bank adopted EB innovations relatively steady, and W bank behaved at least as equally as F bank and H bank did. Specifically, E bank and W bank adopted Internet banking much more earlier than the other two banks did, and they enjoy a greater number of subscribers and transactions. Thus, TR theory, developed to explain the adoption of EB for banks in Italy, seems to be generally invalid in Taiwan, while the results of the data analysis tends to coincide with the predictions derived from the innovation burden theory developed by this study.

Interestingly, almost all the informants in the banks agreed that IT literacy would benefit their EB adoption significantly. However, they identified two different kinds of IT literacy. The first, Mass Automation literacy, assists only in the deployment of Mass Automation applications, but is not automatically transformed into an EB literacy, a culture with management and employees discovering the key role and gaining the experience in the use of EB. Evidence indicates that both E and W bank possess abundant EB literacy. For example, in both W and E bank, employees with NT or Windows-based applications experience were over one half. However, in H bank, only one fifth of its employees had the same experience. This factor may also contribute to their superior

performance of EB adoption. Just As one informant puts it:

We adopted Mass Automation systems more than 20 years ago, and we had developed a mature model for designing related applications. The operation procedures for each application should be in accordance with that model. Every employee can learn to use such systems efficiently and effectively, after all, they accumulated such related experience for almost 20 years. But, the Internet banking is a quite different picture, it needs a totally different model....

Since Buzzacchi et al. (1995) developed the concept of IT literacy based on absorptive capacity, we infer that the role of IT literacy, similar to technological accumulation, should be examined in the context of interrelated technologies.

To summarize, this study has found that:

1. Innovative burden theory may be a better explanation for the rule and influence of technological accumulation;
2. The operative definition of IT literacy may be refined, and
3. The findings of this study can be used to enrich the Technological Regime theory.

5. Discussion and Conclusion

5.1 Conclusions and Theoretical Implications

The results of this study reveal that organizational innovation is a complex phenomenon that might prove traditional organizational innovation theory imprecise. Traditionally, OI theory holds that organizations are either innovative or non-innovative. It also believed that organizations' innovative behavior is stable enough that innovative firms will continually adopt innovation. However, the empirical evidence of this study shows that the innovative behavior of the four case banks varied from time to time. This finding seems controverts to the above belief.

Damanpour(1991) points out that most organizations are very likely "intermittently-innovative" in nature. He argued that extant innovation researches rarely investigate characteristics of this kind of organization. It seems that OI theory is inadequate in describing and explaining the variation of organizational innovativeness of intermittently innovative firms in general, the four case banks in specific. In addressing the above question, he argues that "the unit of adoption could be a set of innovations of different kinds, the adoption of innovations in one part would enhance (or hinder) the adoption of innovations in other parts (p.584)."

Technological Regime theory is perhaps a theory that follows the above perspective and may give a proper explanation to raise our understanding about intermittently innovative firms. Technological Regime claims that, due to the disruption of technological trajectories, the technology accumulation in former generation will have no use in learning and absorbing new technologies. Hence, it is reasonably to assert that technology accumulation should play no role in the adoption of new generation innovations. On the other hand, IT literacy accumulated in the former generation endows banks with the necessary absorptive capacity. Why did the innovative efficiency of large banks shift from active to conservative in the past years? When facing every kind of EB innovation, why is there different innovative efficiency in these banks? Technological Regime theory cannot explain these issues properly.

Instead, Innovative Burden theory provides some interesting findings. This study, responding to the above argument, exploits the concept of technological inter-relatedness to re-examine the role of technological accumulation in and it's effects on organizational innovation. An organization's technological accumulation may endow it with absorptive capacity to adopt innovations. But, in a context of inter-related innovations, when technological disruption begins, a firm's technological accumulation may not related to the new technological trajectories gestated in this new generation, it may thus suddenly be transformed into a burden that constraints the current innovation adoption.

We believe this is one of the reasons why both of F and H bank gradually becoming laggards in the EB era. This finding is not only consistent with Cohen and Levinthal(1990), but also furthers our understanding about firms' adoption of emerging information technologies.

Technological Regime theory states that the main influence on organizational innovative efficiency is consumer need. Yet TR theory may need modification because it neglects some key points of IT literacy. IT literacy is developed from innovation absorbing ability and has one important premise: when people learn new techniques, it is possible to apply the experience, knowledge and skills they already possess. Buzzacchi et al. state the difference between the MA system and EB. He also proposes that the accumulated knowledge, experience and skill of organizational members can help them understand consumers' need and adopt EB. These two statements seem paradoxical.

The results indicate that the enlarging and increasingly coherent technology accumulation is like a two-edged sword. It may eventually become a burden to the adoption and implementation of unrelated innovations. Hence, we surmise that the traditional belief that a rational or high performance organization will adapt itself, in a consistent manner, to continually adopt many contemporary innovations may be problematic. Since firms, during their history, may acquire many innovations belonging to many different systemic technologies, the inclination for firms to adopt an innovation may be influenced by a complex combination of positive and negative forces that originated from its technological base. In this regard, Lee (1994) argues that, in the presence of a set of interrelated innovations, firms' may place greater stress on the appropriate timing of the adoption than the earliness of the adoption. We therefore believe that, if future studies would focus on the adoption timing, a greater contribution to more generalized innovation research would be made.

The idea that rational or high performance firms would be early adopters and acquire a non-trivial advantage over laggards, prevails in traditional innovation literature. However, without careful planning, a firm might enter the arena too early, when technologies are still emerging, and find itself stranded in peril. The development risks could be further heightened if the technological accumulation is unfavorable to the current adoption of an innovation, or the implementation of the current innovation induces a huge organizational change. The remaining firms may instead choose to wait for the uncertainty surrounding new technological features to diminish, thereby observing and profiting from early adopters' experiences. However, once the current innovation became dominant, this strategy may encumber laggards with the competitive risk of falling far behind the early adopters. Therefore, a trade-off between competitive needs and development risks in determining the most appropriate time of adoption, might be as important as the selection of alternate technologies. From this viewpoint, we believe that the prevailing thought concerning the first-mover advantage may be problematic and may have to be further scrutinized and elaborated.

Organizational readiness, in terms of technology accumulation, has a critical impact on technology implementation. We observed that early adopters implement technology slowly, while later adopters, with a higher degree of technology accumulation, implement and succeed with new innovations more readily. For example, E bank and W bank introduced credit cards comparatively late, but the amount of transactions, funds, and card numbers issued were all much higher than that of F bank and H bank. This result supports some researchers' argument that concentrating on extent of implementation comes closer to what we actually want to examine (Damanpour, 1991; Rogers, 1983).

The interrelatedness between information technologies may help explain part of the problem of organizational adoption and implementation of innovations. Rogers(1983)] also proposes the

concept of technological cluster and argues that “the adoption of one new idea may trigger the adoption of several others (p.226).” Empirical evidence suggests that organizations are inclined to be adopter if they were deploying earlier interrelated innovations (Wozniak, 1984). Thus, we suggest researchers to change their focus from an individual innovation or a few unrelated innovations to a set of interrelated innovations.

5.2 Managerial Implications

This can give firms and technology providers many important directions in technology application. From the successful adoption of EB, we know that banks should invest in high technology or e-bank related accumulation. In addition, decision makers should know that adopting innovations is different from continuously using innovation. The popular usage of EB requires a long process of organizational learning. Organizations have to plan proper strategies, such as providing educational training, participating in user groups, and accumulating related professional abilities and IT literacy.

In order to implement innovations, organizations must consider how to smoothly transit between technologies. They can use a variety of technologies, eliminate old technologies, or test innovation continuously. If the strategy cannot maintain the flexibility needed, it may cause rigid innovative ability. Banks without enough technology accumulation that invest in EB should be monitored carefully. Finding experts or consultants for new technological knowledge, or training seed teachers to transfer their experience, should decrease the degree of informational burden. Bankers should also consider how to support EB development, and how to implement the technological experience, knowledge, and skills that EB needs. An organization must also consider the importance of outsourcing carefully, taking into account cost and time. As for e-banking with strategic value, banks should consider their need for technology accumulation and try to accrue their own technological experience and ability instead of outsourcing.

Investigating the influence of timing on EB adoption will help providers design proper strategies for technology promotion and devise superior marketing plans. Providers must also consider if its product or technology is useful to bankers. If it is, providers must accumulate professional knowledge and become technology leaders to help bankers achieve “developing different products to satisfy marketing need and promote competitive ability”.

This study, through literature review and an exploratory study, tests an established theory, and open an avenue to refine it. Future research can examine the validity, the explanation of innovative burden theory in detail, and discuss or define important concepts. There are also some interesting, but vague, topics, such as the concept of IT literacy and influences IT has on innovative adoption. Researchers can discuss these open issues to develop more complex research models. Finally, researchers should perform confirmatory research for statistical generation. They can replicate this study in different situations, such as the Internet, to evaluate the proper conditions for innovative burden theory.

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Appendix 1 : The background of the informants and the interviews records

Name of the Bank	No of Interview	Position of Informant	Time of interview	No of pages of the transcript (in A4 size)
F Bank	1	Vice director, IT Department	2 and half an hour	21
F bank	2	Manager and section chief, Department of Trust	2 hours	40
F bank	3	Vice section chief, Department of Trust	1 hour and 40 minutes	
A bank	4	Director, IT Department	2 and half an hour	27
H bank	5	Senior professional staff, Professional staff	2 hours and 10 minutes	34
F bank	6	Vice director, IT	1 hours	8
H bank	7	Senior professional staff	1 hour and 40 minutes	11
F bank	8	Section chief and staff, Department of Trust	2 hours and 10 minutes	39
F bank	9	Section chief	1 hour and 40 minutes	
E bank	10	Manger, E-banking service	1 and half an hour	43
E bank	11	Manger, E-banking service	2 hours	
H bank	12	Section chief, system development	3 hours and 45 minutes	37
C bank ²	13	Vice president, IT	2 hours	33
H bank	14	Section chief, system development	1 hour and 45 minutes	39
H bank	15	Staff of a EB system	1 hour	25
H bank	16	Staff of another EB system	1 hour and 40 minutes	31
F bank	17	Two vice Section chiefs of two EB systems	2 hours and 20 minutes	40
F bank	18	Vice Section chiefs of two EB systems	2 hours and 20 minutes	35
W bank	19	Director, IT Department	2 Hours	32
F bank	20	Staff of a EB system	2 hours and 20 minutes	39
F bank	21	Staff of a EB system		

² According to the findings of the first interview, these two banks are not suitable for testing the TR theory. So they were gave up as candidate case.